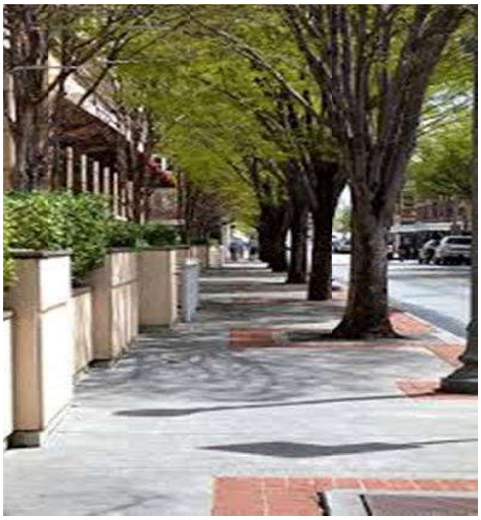
APPENDIX 3

Site Design Measures

Tree Planting and Preservation

Description



Trees intercept rain water on their leaves and branches, allowing water to evaporate or run down the branches and trunk where it readily infiltrates into the soil. Tree roots also increase infiltration of the soil. Runoff reduction credits can be applied for newly planted or preserved trees.

At a minimum inspection and maintenance shall include the following:

- Annual inspection prior to the rainy season.
- Annual proper watering and application of mulch.
- Routine pruning and weeding as needed.
- Replacement of trees as needed.

Technique

At time of planting, newly planted trees must have:

- A trunk measuring at least 1-inch in diameter, 6-inches above the soil line
- A height of at least 6-feet for deciduous trees and 4-feet for evergreen trees.

A minimum of two deciduous trees or one evergreen tree must be planted to use this credit, such that a minimum of 200 square feet of runoff reduction credit is achieved for newly planted trees.

Additionally, to use the runoff reduction credit for existing trees, the canopy area must be:

- Equal to, or greater than 300 square feet of existing tree canopy, such that a minimum of 150 square feet (50% credit for existing canopy) of runoff reduction credit is achieved for existing trees.
- Existing trees must be adequately protected during construction

Credits

The following tree credits apply:

- New deciduous trees provide a tributary area reduction credit of 100 ft^2
- New evergreen trees provide a tributary area reduction credit of 200 ft^2
- Existing trees provide a credit equal to half of the existing tree canopy area.

Rain Barrels and Cisterns

Description

Rain Barrels and Cisterns are a system that collects and stores storm water runoff from a roof or other impervious surface. These typically have overflow mechanisms or plugs that drain to a vegetated area or to the storm drain system when the barrel is full.

Use of Rain Barrels and Cisterns must comply with local vector control requirements.

Technique

Show the following on your site plan:

- Impervious area tributary to each Rain Barrel / Cistern
- Location of each Rain Barrel/Cistern

Confirm the Following Standard Specifications have been met:

- Rain Barrels are sited at grade on a sound and level surface at or near the ground.
- Gutters tributary to the Rain Barrels/Cistern are screened with a leaf guard or maximum ½-inch to ¼ inch minimum corrosion resistant metallic hardware fabric.
- Water collected will be used for irrigation purposes only.
- Openings are screened with a corrosion-resistant metallic fine mesh (1/16 inch or smaller) to prevent mosquito harborage.
- Large openings are secured to prevent entry by children.
- Rain Barrels and Cistern are cleaned annually.

Credits

Runoff reduction credits can be applied for rain barrels or cisterns installed.

- A minimum rain barrel or cistern capacity of 55 gallons must be installed to use this credit

Rooftop and Impervious Area Disconnection

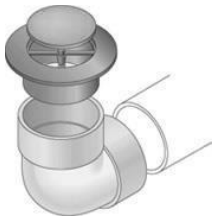
Description

Disconnection of rooftop and impervious areas from the storm drain system helps reduce runoff and provide pollutant removal as the re-directed water travels over and through vegetation and soil instead of being directly piped and discharged into the storm drain. Roof runoff is directed to spread over a pervious area such as a stream setback and buffers, areas of soil quality improvement, or other appropriate infiltration areas.

The following are examples of ways to implement rooftop disconnection:

Splash Block
Splash blocks reduce the velocity and impact of water exiting the roof downspout and direct water to a pervious area.

Pop-up Drainage Emitter
Pop-up drainage emitters are useful in conveying storm water from roof downspouts into vegetated areas. Roof runoff is piped then released through a capped device that opens with water pressure, allowing the storm water to flow out of the emitter and into the vegetated area.



Technique

On Site Plan Show:

- Delineate the impervious tributary area draining to the pervious area
- Show how the runoff will be directed to the pervious area

Confirm that the following specifications will be met:

- Tributary area (impervious area) does not exceed more than twice the pervious area
- Roof areas collect runoff and route to the suitable pervious area
- Paved areas are sloped to direct runoff to suitable pervious area
- Runoff is dispersed across the pervious area (splash block or pop-up emitter)
- Pervious area has vegetation and soils meeting the requirements of stream setbacks and buffers or areas of soil quality improvement and maintenance

Credits

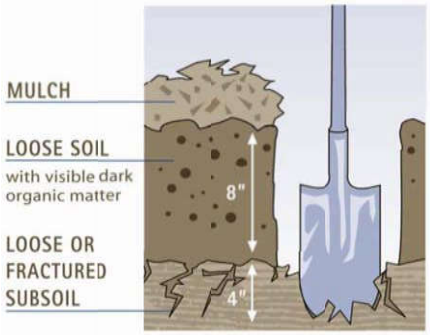
Runoff reduction credits can be applied for the area of rooftop and impervious area disconnection.

- The runoff reduction credits (square feet) will be equal to the area of rooftop and impervious area disconnection and should not exceed more than twice the pervious area receiving runoff.
- A minimum area of 150 square feet of impervious surface tributary area must apply to use this credit.

Soil Quality Improvement and Maintenance

Description

In areas subject to grading/clearing not covered by impervious surface, create/amend pervious areas with a 12" layer of topsoil. Soil quality improvement options include the following:



Technique

Option 1: Leave native vegetation and soil undisturbed and protect from compaction during construction

Identify areas of the site that will not be stripped, logged, graded, or driven on, and fence off those areas to prevent impacts during construction. If neither soils nor vegetation are disturbed, these areas do not require amendment.

Option 2: Amend existing site topsoil or subsoil

Scarify or till subgrade to 8 inch depth (or to depth needed to achieve a total depth of 12 inches of un- compacted soil after calculated amount of amendment is added). Entire surface should be disturbed by scarification. Amend soil to meet desired organic content.

Option 3: Stockpile existing topsoil during grading. Replace topsoil before planting.

Stockpile and cover soil with weed barrier material that sheds moisture yet allows air transmission. Replace stockpiled topsoil prior to planting and ensure that replaced soil plus additional compost as needed will amount to at least 12 inches of depth.

Compost/amendment shall be mature, stable, weed free, and produced by aerobic decomposition of organic matter.

Credits

Runoff reduction credits can be applied for the area of soil quality improvement.

- The runoff reduction credits (square feet) will be equal to the area of soil quality improvement.
- A minimum area of 150 square feet of soil quality improvement area must apply to use this credit.

Green Roofs

Description

A green roof is a multi-layered, vegetated rooftop system design for filtering, absorbing, and retaining stormwater. A green roof captures stormwater within the pore space of the growth medium and then releases the water slowly via evaporation, transpiration, and discharge to the roof drains.

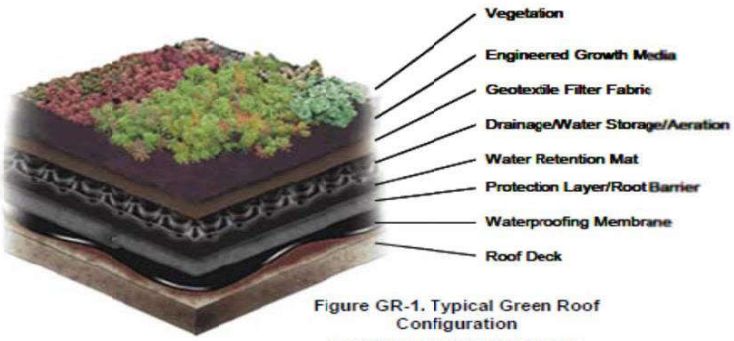


Figure GR-1. Typical Green Roof Configuration

Image source: American Hydrotech, Inc.®, http://www.hydrotechusa.com/. Text detail added.

Technique

Green roof installation should be considered during building design, as green roofs require special structural reinforcements, irrigation provisions, and leak protection elements. Involve the landscape architect, licensed structural engineer, and mechanical engineer early in the design process with the project architect, since architectural roof style, roof structural requirements, building heating/cooling needs, vegetation selection, and irrigation needs go hand in hand.

Routine inspection of the roof membrane, drainage layer flow paths, and irrigation system is needed. Periodic maintenance and replacement of rooftop vegetation and growth media should be expected during the lifespan of the green roof.

Credits

Runoff reduction credits can be applied for area of installed green roof.

- A minimum area of 150 square feet of green roof must be installed to use this credit.

PPPP - Porous Asphalt, Pervious Concrete, Permeable Pavers – (alternative engineered hardscaping surfaces)

Description

This option can be easy to install and maintain, cost effective, and can add aesthetic value to your project. PPPP may include pervious concrete, porous asphalt, porous pavers, crushed aggregate, open pavers with grass or plantings, open pavers with gravel, or solid pavers.

Technique

Show on your site plan:

- Location, extent and types of pervious pavements.

Confirm the following standard specifications are met:

- No erodible areas drain on to permeable pavement.
- Subgrade compaction is minimal.
- Reservoir base course is of open-graded crushed stone. Base depth is adequate to retain rainfall (3 inches is adequate) and support design loads (more depth may be required).
- No subdrain is included or, if a subdrain is included, outlet elevation is a minimum of 3 inches above bottom of base course.
- Subgrade is uniform and slopes are not so steep that subgrade is prone to erosion.
- Rigid edge is provided to retain granular pavements and unit pavers.
- Solid unit pavers, if used, are set in sand or gravel with minimum 3 / 8 inch gaps between the pavers.
- Joints are filled with an open-graded aggregate free of fines.
- Pervious concrete or porous asphalt, if used, are installed by industry-certified professionals according to the vendor's recommendations.
- Selection and location of pavements incorporates Americans with Disabilities Act requirements (if applicable), site aesthetics, and uses.

Credits

Runoff reduction credits can be applied for area of installed porous pavement.

- A minimum area of 150 square feet of pervious pavement must be installed to use this credit.

Vegetated Swales

Description

A vegetated swale is a broad, shallow channel with dense vegetation covering the bottom and side slopes. Vegetation in the channel provides filtration and solids removal and reduces flow velocities as stormwater is conveyed through the system. Depending on soil type, some infiltration may also occur, decreasing runoff volume and providing additional filtration.

Technique

Vegetated swales are suitable for the following conditions:

- Areas with a maximum slope of 5%
- Areas wide enough to provide a bottom width between 2 ft and 10 ft
- Areas wide enough to provide a 3:1 side slope
- Areas long enough to provide at least 100 feet of swale length

Flow depth should be limited to 4 to 6 inches with a maximum velocity of 1 foot per second for water quality treatment. Under higher flow conditions, the maximum velocity should be 3 feet per second to avoid erosion. Swale should discharge to a piped system or can function as a confined channel if sized large enough to do so. If the swale discharges to a slope rather than to a piped system, an energy dissipater should be used at the swale outlet.

Credits

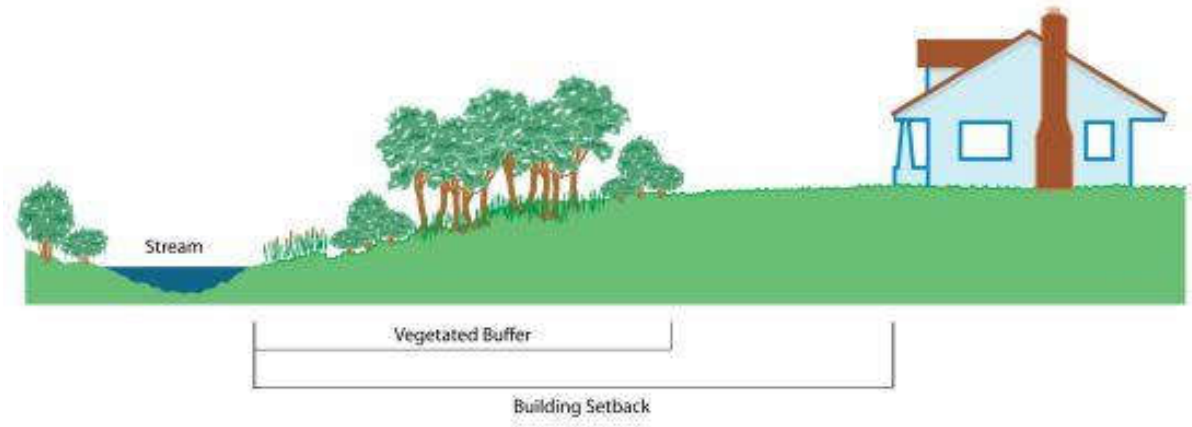
Runoff reduction credits can be applied for area of installed vegetated swale.

- A minimum area of 150 square feet of vegetated swale must be installed to use this credit.

Stream Setbacks and Buffers

Description

A stream setback or buffer is an area along a shoreline, wetland, or stream where development is restricted or prohibited. The primary function of setbacks and buffers is to physically protect and separate a stream, lake or wetland from future disturbance or encroachment. If properly designed, setbacks and buffers can provide stormwater management and act as a right-of-way during floods, sustaining the integrity of stream ecosystems and habitats.



Technique

Stream setbacks and buffers should be considered as part of the initial phases of site design for the project. Provisions should be made to place impervious developments and areas to be impacted or disturbed furthest from the aquatic feature, with a zone of natural, undisturbed vegetation remaining between the stream and the areas impacted by development.

Contact County or City Department with project jurisdiction for stream setback and buffer requirements and design criteria.

Credits

Runoff reduction credits can be applied for the area of stream setback and buffer.

- The runoff reduction credits (square feet) will be equal to the area of stream setback and buffer.
- A minimum area of 150 square feet or more of stream setback and buffer must apply to use this credit.

Infiltration Trench

Description

An infiltration trench is a long, narrow (<25 ft.), rock-filled trench (depth between 3-8 ft.) that receives stormwater runoff and allows it to infiltrate.

Infiltration trenches typically have no outlet. Before entering the trench, runoff should pass through stormwater pretreatment measures, such as pre-settling basins, to remove coarse sediment that can clog the void spaces between the stones and render the trench ineffective. A level spreader may be used to spread concentrated flows.

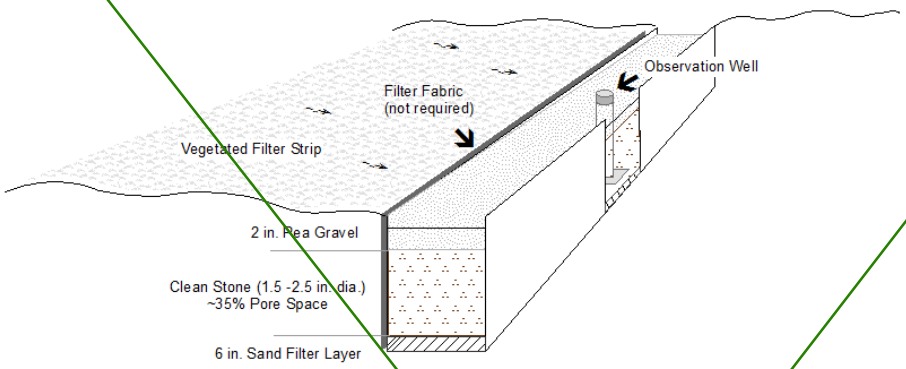
Pretreated runoff is stored in the void spaces and slowly infiltrates through the bottom of the trench into the soil matrix, thus contributing to groundwater recharge. Infiltration trenches should be designed to operate offline, such that only design flows are diverted to the trench and the remainder is bypassed.

⚠ Due to the potential to contaminate groundwater and/or soils, cause slope instability, impact surrounding structures, and the potential for insufficient infiltration capacity, adequate soil infiltration and BMP siting must be demonstrated, please follow the steps below.

Infiltration trenches are generally between 3 (minimum depth) and 8 feet deep and not more than 25 feet wide. They should:

- Have a level surface and bottom to promote uniform infiltration across the trench;
- The top two inches should be a pea gravel filter layer.
- Trench fill material should be double washed locally available rock with a diameter range of 1.5 to 2.5 inches,
- Below the rock layer is a 6-inch deep sand filter layer. The sides of the trench can be lined with filter fabric to prevent adjacent soils from clogging the rock; and,
- An observation well located at the center of the trench is recommended to monitor water drainage from the system. The well can be a capped 4 to 6-inch diameter PVC pipe, which is anchored vertically to a foot plate at the bottom of the trench
- The infiltration trench should be designed to drain within 72 hours.

Infiltration Trench



Overflow: Infiltration trenches should be designed such that only design flows are diverted to the trench and the remainder is bypassed.

☐ Utilize the Small Project or Regulated Project (Worksheet 2) Calculators for documenting runoff reduction achieved based on the size of the proposed infiltration facility.

Requirements for Credit

On Site Plan Show:

☐ Delineate the impervious tributary area draining to the infiltration system

☐ Show how the runoff will be directed to the infiltration system

☐ Show the percent and direction of land slope for the site

☐ Show a cross-section of the proposed trench on the plan with dimensions clearly noted

Confirm that the following specification will be met:

☐ Infiltration trench must be located at least 5 feet from the parcel property lines.

☐ Infiltration Trench must be located at a minimum of 10 feet (down gradient) from building foundations. Exceptions may be granted if a mounding analysis, conducted as part of a geotechnical report, clearly shows that no potential impact to the structure will result from a closer setback, Appendix 8 Mounding Analysis Procedures.

☐ Infiltration trench must be located 100 feet or greater from water wells, monitoring wells, springs and flowing surface water bodies, and from unstable land masses.

Infiltration Trench

- ☐ Infiltration trench must be located 100 feet or greater from the high water mark of vernal pools, wetlands, lakes, ponds, or other surface water bodies.
- ☐ Infiltration trench must be located 1,200 feet or greater from any public water systems' surface water intake point.
- ☐ Pretreatment systems, debris/sediment traps and filter strips, are recommended for all facilities and may be required by the jurisdictional entity on facilities that capture runoff from roofs, roads, and parking areas (check with the jurisdictional entity for minimum filter strip widths).
- ☐ Inspection port is accessible.
- ☐ Slopes are less than 20% unless constructed to the recommendations in a geotechnical report.
- ☐ Infiltration trench must be located at least 25 feet from slope break on slopes greater than 30%. A mounding analysis, conducted as part of a geotechnical report, is required for set backs less than 25 feet
- ☐ The depth to seasonal high groundwater level is greater than 5 feet, measured from the bottom of the trench. If groundwater depth is found to be less than 5 feet, a mounding analysis conducted as part of a geotechnical report will be required. Groundwater level determination shall be made using methods described in Humboldt County's, Wet Weather Testing of Soils, using either soil mottling or direct observation techniques.
- ☐ Must comply with local vector control requirements.
- ☐ There shall be no adverse impact to adjacent properties.
- ☐ No contaminated soils shall be on site.

Infiltration Rate Requirements

Infiltration rates of the soils underlying the proposed infiltration system must be documented; the following is the acceptable method and required documentation:

Soil grain analysis using ASTM D 422D, *Standard Test Method for Particle-Size Analysis of Soils,* shall be performed within the boundaries of the proposed infiltration facility and at the bottom elevation/cut (infiltration surface) of the proposed infiltration facility.

☐ Check if particle size analysis results in less than (<) 50% fines – **Stop** - Compliance has been met.

☐ Check if particle size analysis results in greater than (>) 50% fines – Compliance has not been met. Procced to percolation testing requirements, below.

Infiltration Trench

A percolation test according to the Humboldt County Environmental Health's *Wet Weather Testing of Soils* must be performed if particle size analysis compliance has not been met.

☐ Percolation is equal to or greater than (≥)1 inch per hour. **Stop** – Compliance has been met. Please include all testing results with submission.

☐ Percolation is less than 1-inch per hour – Compliance has not been met. Please, meet with jurisdictional authority for alternative compliance requirements (Mounding Analysis Procedures)

Meeting all of the criteria on this worksheet does not guarantee approval of these devices. Infiltration facilities proposed in areas with high groundwater and in close proximity to waterbodies impaired for pathogens may not be approved regardless of meeting the above requirements.

Alternatively, areas that may not meet the above requirements have the opportunity to request a waiver. However, it must be demonstrated that groundwater surfacing and impacts to structures will not result from the placement of the facility. Please consult with your jurisdictional permitting authority for additional requirements and considerations.

An infiltration trench that is to be designed to address limitations in the down stream conveyance system may be required to submit percolation and groundwater elevation testing reports to the jurisdictional permitting authority for approval.

☐ An operation and maintenance plan must accompany permit submission (does not need to be recorded against the deed).

Projects that do not meet the above requirements may request a waiver, issued on a case-by-case basis. Please contact jurisdictional entity for the necessary information needed for an alternative compliance waiver.

Please include this sheet with application.

Link to Environmental Health Department's Wet Weather Testing of Soils:

http://www.humboldtgov.org/685/Land-Use-Program

OWTS Policy, Water Quality Control Policy for Siting, Design, Operation, and Maintenance of Onsite Wastewater Treatment Systems, June 19, 2012.

http://www.swrcb.ca.gov/water_issues/programs/owts/docs/owts_policy.pdf

Subsurface Infiltration Devices – Dry Wells, Galleries and Proprietary Systems

Description

A number of underground infiltration systems, including premanufactured pipes, vaults, and modular structures, have been developed as alternatives to infiltration trenches and basins for space-limited sites and stormwater retrofit applications. Similar to traditional infiltration facilities, these systems are designed to capture, temporarily store, and infiltrate stormwater over several days. Performance of underground infiltration systems varies by manufacturer, system design, and site conditions.

The materials of construction, configuration, and lay-out of underground infiltration systems vary considerably depending on the system manufacturer. Specific design criteria and specifications for these systems can be obtained from system manufacturers or vendors.

Sizing and Materials

General design requirements common to most of these systems are summarized below and must be followed if used as a site design measure.

☐ Utilize the Regulated Project Calculator (Worksheet 2) for documenting the runoff reduction achieved based on the size of the proposed infiltration facility.

⚠ Due to the potential to contaminate groundwater and/or soils, cause slope instability, impact surrounding structures, and the potential for insufficient infiltration capacity, adequate soil infiltration and BMP siting must be demonstrated, please follow the steps below

However, meeting all of the criteria on this worksheet does not guarantee approval of these devices. Infiltration facilities proposed in areas with high groundwater and in close proximity to waterbodies impaired for pathogens may not be approved regardless of whether all requirements have been met. Please consult with your jurisdictional permitting authority for additional requirements and considerations.

Subsurface Infiltration Devices – Dry Wells, Galleries and Proprietary Systems

Requirements For Credit

On Site Plan Show:

- ☐ Delineate the impervious tributary area draining to the infiltration system
- ☐ Show how the runoff will be directed to the infiltration system
- ☐ Show the percent and direction of land slope for the site
- ☐ Show a cross-section of the proposed system on the plan with dimensions called out

Confirm that the following specification will be met:

- ☐ Subsurface infiltration facility must be located at least 5 feet from the parcel property lines
- ☐ Subsurface infiltration facility must be located at a minimum of 10 feet (down gradient) from building foundations. Exceptions may be granted if a mounding analysis, conducted as part of a geotechnical report, clearly shows that no potential impact to the structure will result from a closer setback (Appendix 8. Mounding Analysis Procedure).
- ☐ Subsurface infiltration facility must be located 100 feet or greater from water wells, monitoring wells, springs and flowing surface water bodies, and from unstable land masses.
- ☐ Subsurface infiltration facility must be located 100 feet or greater from the high water mark of vernal pools, wetlands, lakes, ponds, or other surface water bodies.
- ☐ Subsurface infiltration facility must be located 1,200 feet or greater from any public water systems' surface water intake point.
- ☐ Subsurface infiltration facility must be located at least 25 feet from slope break on slopes greater than 30%. A mounding analysis, conducted as part of a geotechnical report, is required for set backs less than 25 feet.
- ☐ Pretreatment systems, debris/sediment traps and filter strips, are recommended for all facilities and may be required by the jurisdictional entity on facilities that capture runoff from roofs, roads, and parking areas (check with the jurisdictional entity for minimum filter strip widths).
- ☐ Inspection port is accessible.
- ☐ Slopes are less than 20% unless a geotechnical report is prepared

Subsurface Infiltration Devices – Dry Wells, Galleries and Proprietary Systems

☐ The depth to seasonal high groundwater level is greater than 5 feet, measured from the bottom of the trench. If groundwater depth is found to be less than 5 feet, a mounding analysis will be required. Groundwater level determination shall be made using methods described in Humboldt County's, Wet Weather Testing of Soils, using either soil mottling or direct observation techniques.

☐ No adverse impact to adjacent property

☐ No contaminated soils shall be on site

☐ Overflow: subsurface infiltration facilities shall be designed to operate offline, such that only design flows are diverted to the facility and the remainder is bypassed

Infiltration Rate Requirements

Infiltration rates of the soils underlying the proposed infiltration system must be documented; the following outlines the method for determining infiltration rate compliance.

Soil grain analysis using ASTM D 422D, *Standard Test Method for Particle-Size Analysis of Soils,* shall be performed within the boundaries of the proposed infiltration facility and at the bottom elevation/cut (infiltration surface) of the proposed infiltration facility.

☐ Check box if particle size analysis results in <u>less than</u> (<) 50% fines. **Stop** - Compliance has been met.

☐ Check box if particle size analysis results in <u>greater than</u> (>) 50% fines. <u>Compliance has not been met</u>. Please, procced to percolation testing requirements, below.

A percolation test according to the Humboldt County Environmental Health's *Wet Weather Testing of Soils,* must be performed if particle size analysis compliance has not been met.

☐ Percolation is equal to or greater than (≥) 1-inch per hour. **Stop** - Compliance has been met. Please include all testing results with submission.

☐ Percolation is less than 1-inch per hour – <u>Compliance has not been met.</u> Please meet with jurisdictional authority for alternative compliance requirements.

Meeting all of the criteria on this worksheet does not guarantee approval of these devices. Infiltration facilities proposed in areas with high groundwater and in close proximity to waterbodies impaired for pathogens may not be approved regardless of meeting the above requirements.

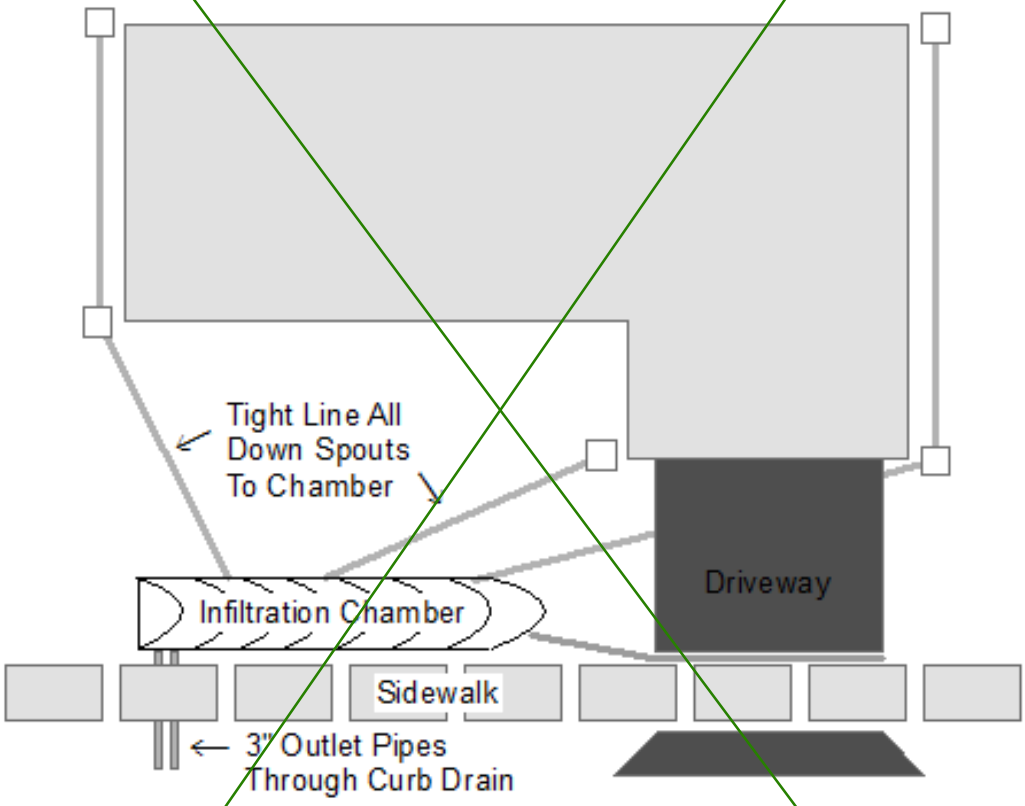
Alternatively, areas that may not meet the above requirements have the opportunity to request a waiver. However, it must be demonstrated that groundwater surfacing and impacts to structures will not result from the placement of the facility. Please consult with your jurisdictional permitting authority for additional requirements and considerations.

Subsurface Infiltration Devices – Dry Wells, Galleries and Proprietary Systems

An infiltration trench that is to be designed to address limitations in the down stream conveyance system may be required to submit percolation and groundwater elevation testing reports to the jurisdictional permitting authority for approval.

☐ An operation and maintenance plan must accompany permit submission (does not need to be recorded against the deed). Operation and Maintenance Plans that are specific to proprietary units and are produced by manufacturer are acceptable. Runoff reduction credits will be proportional to the volume of available storage in infiltration device.

Example Schematic



References

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